



Since January 2020 Elsevier has created a COVID-19 resource centre with free information in English and Mandarin on the novel coronavirus COVID-19. The COVID-19 resource centre is hosted on Elsevier Connect, the company's public news and information website.

Elsevier hereby grants permission to make all its COVID-19-related research that is available on the COVID-19 resource centre - including this research content - immediately available in PubMed Central and other publicly funded repositories, such as the WHO COVID database with rights for unrestricted research re-use and analyses in any form or by any means with acknowledgement of the original source. These permissions are granted for free by Elsevier for as long as the COVID-19 resource centre remains active.



# Implementation Status and Development Thinking on “Cloud National Examination” in China under the situation of “Online Anti-COVID-19 Epidemic”



## ARTICLE INFO

### Keywords:

Cloud National Examination  
Online Anti-COVID-19 Epidemic  
Implementation Status  
Analysis and discussion  
Thinking and enlightenment  
Empirical Research

## ABSTRACT

At the beginning of 2020, China was first hit by the COVID-19 epidemic. In order to effectively prevent the spread of the virus, the Chinese people work online, teach online, study online and shop online from home, the whole country rapidly entered the era of “Cloud Anti-COVID-19 Epidemic”. With the passage of time, the Chinese relevant national examinations such as postgraduate second round examination, the senior high school and college entrance examination gradually approach. In response, some regions have launched the “Cloud National Examination” model. Based on this background, through the actual situation commentary and case proof of adaptive mock test of the “Cloud National Examination” that has been carried out in some areas and schools, this article analyzes, discusses, summarizes and deeply reflects the epidemic prevention and control, policy formulation, education care, scientific and technological progress, and social problems hidden behind the hot phenomenon of “Cloud National Examination”, so as to offer advice and suggestions for online education in such a special period. Also, to provide reference for the rapid deployment, preparation and implementation of “Cloud National Examination” by relevant education administrative departments, schools, candidates and their families, and supply the evaluation viewpoint and theoretical contribution for similar global problems and phenomena.

## 1. Introduction

Since the first novel coronavirus pneumonia case was been confirmed in December 2019 in China, the whole country rapidly entered into the situation of epidemic control and prevention, and the spread of the epidemic has been rapidly and effectively controlled by the country's efforts to fight the disease. As of 24:00 on April 15, 2020, a total of 82341 cases had been confirmed in 31 provinces (regions, cities) in mainland China, new confirmed cases of the day being 46. (China National Health and Health Commission 2020) The number of new cases per day dropped rapidly from the previous thousands to dozens, and confirmed cases have been cleared in some provinces. To achieve this effect, one of the important measures was to postpone the study in schools and the production in companies, reducing the flow of people as much as possible; people live at home as much as possible, employees work from home as much as possible, and students have classes at home as much as possible. At one time, the entire society entered the “Cloud Era”, people use “Cloud Office”, “Cloud Education”, “Cloud Tourism”, “Cloud Medical Treatment”, “Cloud Shopping”, “Cloud Finance”, and other practical actions that have realized “Cloud Anti-COVID-19 Epidemic”, and hit hard at the head of COVID-19 epidemic. In the current situation, although the prevention and control of the epidemic has achieved an important stage of victory, and the domestic epidemic has gradually ceased, the international epidemic is surging, and many countries frequently raise alarms, and the global situation of fighting the epidemic is not optimistic. Therefore, we must not take a casual

attitude at present. Enterprises in key areas involving the lifeblood of the national economy should be fully promoted to return to work and production, but the field of education should remain in the “Cloud Era”. As of July 2019, there were “276 million students at all levels of academic education in schools across the country,” (China's Ministry of Education 2019) together with teachers, managers and parents associated with students' study and life, the total number of them should at least double. In the face of an extremely large and complex population, the relevant departments of the state are extremely cautious about this, which can be seen from the still unclear school opening time. In response to this situation, China's Ministry of Education has put forward the requirements of “non-stop teaching and non-stop learning, online teaching and online learning”. Therefore, online education and teaching are in full swing in all kinds of schools at all levels. Although the vast majority of students have successfully entered the online learning stage with the passage of time, the pace of large-scale national examination approaches, such as the postgraduate second round examination in April or May, as well as the senior high school and college entrance examination in June, even national civil service examination, art examination and postgraduate preliminary examination at the end of the year, and how to implement these national examinations has become the focus of public and social concern. On February 12, 2020, officials of China's Ministry of Education replied to such questions at the press conference of the joint defense and joint control mechanism of the State Council, which is to “carefully study and formulate relevant specific plans, and relevant work arrangements will be announced to

<https://doi.org/10.1016/j.techfore.2020.120322>

Received 16 April 2020; Received in revised form 27 August 2020; Accepted 13 September 2020

Available online 08 October 2020

0040-1625/ © 2020 Elsevier Inc. All rights reserved.

the public in a timely manner”. (Yufei, 2020)

Although the government has issued relevant announcements, how to solve it needs careful argumentation and systematic consideration, which is also the main correspondence of this paper. There are a series of problems: the first level is also a prerequisite, that is, whether to carry out online examination on schedule or to postpone the implementation of traditional offline examination. If it is a delay, when will it be postponed to? Of course, there is also a third scheme, that is, whether to carry out online examination on schedule in areas with conditions, and to implement traditional offline examination in areas lacking network equipment and technology after the risk of epidemic situation is reduced. This scheme has the most uncontrollable factors. How will the epidemic situation develop? When can the epidemic situation be effectively alleviated? What are the criteria for low risk? Who is responsible for the risk of infection in the process of large-scale examination? How to deal with emergencies? The same examination is not carried out synchronously in different regions, and the examination forms are different, so the examination contents and processes are bound to be different. How to establish the standard of assessment effectively? How to evaluate and guarantee fairness and justice? The second level of the problem, namely, the specific operational level problem, is mainly divided into two aspects. The first aspect is to postpone the implementation of the traditional offline examination, which involves a lot of overlapping problems with the third scheme of the previous level. No matter how large the scale is, China's offline national examination operation has been much matured. The difficulty lies in the fact that the variable factors of the epidemic situation and the future development trend cannot be accurately determined, because the scale of China's cloud national examination is very large. In 2020, there will be more than 4 million postgraduate candidates and doctoral candidates in the entrance examination, 10.71 million in the college entrance examination, and more than 10 million students in the senior high school entrance examination; and it is extremely important for individuals, families and society. Therefore, it is necessary to implement large-scale offline national examination within a very controllable range. When will this time point appear, and for how long can it be postponed? Because all processes are interrelated, the postponement of the examination is bound to cause the delay of enrollment, term opening and teaching, and other aspects. The number of Chinese students is huge, and any change involves a wide range of aspects and must be comprehensively studied and prudently implemented. The second aspect is to conduct online examinations. This is the most feasible way. First, the “Internet + Education” strategy has been implemented in China for several years, which requires all schools to connect to the Internet by 2022. Therefore, many areas have improved greatly in the network hardware and software facilities. Second, the large-scale outbreak of the COVID-19 epidemic in China in 2020 has greatly promoted online education, and online teaching in schools at all levels has been fully launched. Personnel deployment, processes implementation, technical support, quality control and so on, have gone through deep running in and entered a comprehensive and better stage. Third, some regions, and colleges and universities have carried out the experiment, simulation and test of “Cloud National Examination” in advance, and accumulated some experience. However, although the feasibility is great, the problem is also very obvious: the school network equipment can be effectively improved, but the online examination involves a large number of individual candidates, how to guarantee their household equipment? How to establish reliable standards for the content and process of online examination? Home online examination environment is complex and changeable, how to deal with cheating in the examination and ensure the integrity of the examination?

In view of the above problems, this paper makes in-depth evaluation, demonstration, discussion and summary from the theoretical level; fully analyzes the pros and cons; and puts forward relevant practical solutions, in order to offer suggestions for the improvement of the implementation scheme of the “Cloud National Examination”; provide

reference for the preparation of “Cloud National Examination” by relevant education administrative departments, schools, candidates and their families; and supply the evaluation viewpoint and theoretical contribution for similar global problems and phenomena.

## 2. Literature Review

As online anti-epidemic and online education are both hot issues in society and have great social impact, many scholars have paid attention to it. The main research points are mainly focused on the following aspects: first, make a detailed study on the relevant links and processes of online examination, such as the construction and application of online examination system question bank (Li Chongqi, 2020); Pang (2020) analyzed various factors that affect the generation of online examination papers, and proposed an automatic test paper generation method for online examination; Xing, Chen, & Wu (2020) paid attention to the examination affairs of online examination and its problem solving, and analyzed the application advantages of online examination in the teaching management of college and university educational administration; Zhang (2019) proposed to set up cloud simulation examination in advance to accumulate experience in the implementation of formal online examination; Shi (2019) focused on the design and implementation of online examination registration and score query system; Li (2020) introduced the online examination system platforms in the United States, Australia and other countries, and proposed how to apply them for reference in China.

Second, focus on the technical level to do a good discussion and research. Wei (2019) specially discussed the design and implementation of online examination intelligent management system; Zhang (2020) proposed to use B/S structure to realize the efficient operation of online examination system in Colleges and universities; using MyEclipse as the development environment, Yang (2020) selected MVC design mode and Struts, Hibernate and other technologies to design each module of the online examination system, and managed the data in each module based on SQL Server database system; based on the analysis of common load balancing technology, through Test algorithm and simulation experiments, Yang (2020) improved the response efficiency of large-scale online examination system; Shu (2020) designed a C/S structure online examination system based on .NET platform, C# as the programming language and SQL Server as the main database; Liu (2020) designed and implemented the online examination system with the front-end and back-end separation architecture mode, the front-end used Vue.js technology, and the back-end used Spring Boot technology; Qi (2020) proposed an online examination system based on PHP + MySQL framework.

Third, design and implement online examination anti-cheating system. Li (2020) proposed that the shielding of special keys can effectively prevent cheating in online examinations; Cui (2019) designed a system of preventing cheating in online examination based on residual network; Ren & Lang (2019) carried out the application research of face recognition technology in online examination; Huang (2020) specially discussed how to avoid “Shadow Scholar” and cheating in online examination.

Fourth, explore the multiple ways, advantages and disadvantages of online education and the social impact. Wei (2020) proposed a multi-dimensional teaching mode of “online course + flipped classroom”; Xu (2020) carried out online teaching of functional experiment based on MOOC and virtual simulation experiment; Zhang & Zhang (2020) proposed to build a harmonious interpersonal relationship system of online education from the problems between teachers and students, students' parents and teachers, caused by large-scale online teaching during the epidemic period; Yi (2020) analyzed the problems faced by the cloud examination system, such as “cloud server availability blocked”, “poor reliability of data computation” and “lack of controllability of client data”; Hu (2020) directly demonstrated the advantages and disadvantages of online education during the epidemic period, and

triggered public discussion and thinking on the future development of online education industry; Wang (2020) focused on the practice and thinking of online education in primary and secondary schools during the epidemic period, and explored the relationship between high quality online education resource balance and large-scale personalized education. From the perspective of family education, Yin (2020) discussed online education consultation during the epidemic period; Hu (2020) studied how to carry out family-school collaboration in online teaching under the epidemic situation.

To sum up, although many scholars and experts have studied and given solutions and paths on relevant issues, there are still some problems, mainly manifested in the following aspects: first, they mainly tend to research and design online examination system of colleges and universities, while there are few researches on online examination completely aiming at the type of national examination. Second, too much attention is given to the examination process, there are few literatures on the proposing, thinking and solving of the social problems related to the complete mechanism of “Cloud National Examination”. Third, there is a lack of prospective research on the future development of the “Cloud National Examination”. Fourth, the existing research fails to organically combine the “Cloud Anti-COVID-19 Epidemic” and “Cloud National Examination”.

Therefore, this paper focuses on the above-mentioned “research gap” to carry out special demonstration and comment on the current situation of “Cloud National Examination”; deeply analyzes all sectors of society's concerns and requirements for the “Cloud National Examination” under “Cloud Anti-COVID-19 Epidemic” situation; then puts forward the necessity of “Cloud National Examination”. At the same time, the difficulties of its implementation are presented and discussed, and finally summarized and prospected.

### 3. Implementation Status of “Cloud National Examination” in China

At the end of January 2020, in response to the rapid response and scientific deployment of epidemic prevention and control, China's Ministry of Education successively issued the notice of “2020 spring semester extension” and “non-stop teaching and non-stop learning, online teaching and online learning”, and then the local education administrative departments and all kinds of schools at all levels fully implemented and actively carried out online teaching. From the education administrative department's clear requirements, overall coordination, policy support, funding guarantee to the school's wide mobilization, comprehensive training, quality monitoring, from teachers' independent creation of online courses, online teaching, and online guidance, to online platform collection of resources, comprehensive expansion, full service, the education administrative department, all kinds of schools at all levels and educational enterprises have experienced not a drill, but a real battle. After more than one month's hard work, the administrative departments, enterprise institutions, schools, teachers and students have been familiar with the processes of online management and the rhythm and frequency of online teaching. After adapting to the online teaching environment, on the one hand, all parties have accumulated rich experience in the field of “cloud teaching”. On the other hand, it has gradually pushed to the “time window” of some national examinations, such as the postgraduate second round examination in April, etc. and new problems that come with it. When the main battlefield of online teaching has achieved major victory, it is necessary to solve local battles with superior forces. The strategy is feasible, and as early as in the SARS period in 2003, there was a precedent of online examination in relevant national examinations, such as some parts of the postgraduate second round examination. Therefore, some regions and universities started the “cloud operation” of relevant large-scale national examinations.

#### 3.1. “Cloud Postgraduate Second Round Examination”

The “time window” for the postgraduate second round examination is the closest to the present, which is the first target for the administrative departments of education and colleges. Although due to the impact of the epidemic situation, the results of the postgraduate preliminary examination have been announced later than before, at this stage, all of them have been announced, and examinees have entered the active preparation for the second round examination. On the other hand, China's Ministry of Education has made it clear that whether the second examination work originally planned to be carried out in April will be postponed or not, it will be notified separately according to the epidemic situation, and colleges and universities are required to try their best to use network information technology to ensure the smooth and orderly progress of the postgraduate second round examination. The release of these signals means that colleges and universities currently need to come up with online-coping strategies once they can't start the offline examination. Judging from the current epidemic prevention and control situation and the practice of some universities, the probability of “cloud second round examination” for graduate students is very high. For example, Beijing Jiaotong University has issued “Novel Coronavirus Pneumonia prevention and control period postgraduate enrollment arrangements” notice on February 11, 2020. It is preliminarily determined that the second round examination is an online examination, at the same time, they put forward the proposal that “the epidemic is not conducive to travel, which is just when students study hard”; the notice of Henan University of Technology issued on February 26, 2020 on “Reserve plan for the second round examination of postgraduate enrollment in 2020” also clearly put forward two plans: the delayed reexamination and the online reexamination. If it is an online reexamination, the traditional interview will be changed to a remote interview, and the traditional written exam will be an online open book exam. Although the above two universities later deleted the relevant content, one stone aroused a thousand waves, causing widespread concern of the society. In addition to the above two colleges and universities, there are also colleges and universities that have issued the online second round examination announcement and have not withdrawn. For example, Northeast Petroleum University (Daqing) made it clear on February 14, 2020 that it plans to carry out the online reexamination in the form of online video and full video recording. Hainan University also announced that it would consider using the online reexamination system as long as the epidemic situation has not been completely eliminated. In fact, from the practice of the above-mentioned colleges and universities, no matter whether the announcement is issued or not, all colleges and universities have been working intensively to demonstrate and plan the implementation method of online reexamination under the state of epidemic prevention and control. Although the region where the author is located has been listed in the low-risk region, the colleges and universities still actively prepare for the online reexamination.

#### 3.2. “Cloud College Entrance Examination”

College entrance examination has always been of concern since the outbreak of the COVID-19. Under the epidemic situation, people's focus has concentrated here the more. In order to deal with and prepare well in advance, Beijing first launched a practical exercise. Beijing Municipal Education Commission launched the adaptability test of the college entrance examination from March 3 to 6, 2020. Although it is called “adaptability test”, it is completely consistent with the formal college entrance examination in terms of the test time, subjects and scope. The college entrance examination in 2020 in Beijing is also a new form, that is, it's not divided into Liberal Arts and Sciences, and subjects are 3 (Chinese, mathematics, English) + 3 (Choose 3 out of 6 subjects). This online model test not only moved the test room into thousands of families, changed the way to “cloud answer sheet” and “cloud hand in”,

but also realizes a series of cloud operations such as “cloud marking”, “cloud scoring” and so on, which can be described as “cloud full processes”. In addition to the mock exam of the Beijing college entrance examination, there are many other practices, such as the online mock test of college entrance examination in Shanxi Province, the joint online test in twelve schools in Fujian, Guangdong and Jiangxi Provinces, the second mock exam of golden sun in Henan Province, and the online second mock examination in Tianhe District, Guangzhou, and so on.

### 3.3. “Cloud Senior High School Entrance Examination”

While college students and senior high school students can face the “cloud operation” of such a big test calmly, for junior high school students with immature mind, cloud model test is a huge challenge. In addition, the exam subjects are not only more than the postgraduate second round examination and the college entrance examination, but also include biology, chemistry, physical experiment and physical ability test. Therefore, the implementation of online exam is much more difficult. However, in order to effectively cope with it, on the one hand, the online mock test of the senior high school entrance examination has been carried out on some online education platform, such as “online mock test for millions of students” in the senior high school and college entrance examination launched by Ape Test Bank. Students in the third grade of junior or senior high school can experience the nationwide “cloud exam”, which cannot only adapt to various cloud operations, but also obtain the nationwide test results ranking for reference. On the other hand, online lectures and courses on how to carry out home physical exercises and physical tests are also being offered in large numbers, and students are also actively preparing for it. This also provides a path and lays a foundation for the inevitable adoption of “cloud senior high school examination” once affected by the epidemic.

## 4. Development Thinking on “Cloud National Examination” in China

### 4.1. Bright points and effects

#### 4.1.1. Humanized care

As we all know, the implementation process of large-scale national examination is strict, the social attention is high, and the influence on examinees is deep. No matter which step has problems, even small problems, it will cause high public concern, or even have a more serious social impact. On the one hand is the heavyweight examination related to the future development of examinees; on the other hand is the most precious life, which is more important, it's easy to judge. Under the situation that the COVID-19 epidemic has not yet turned around, the preparation of “Cloud National Examination” and the full efforts of relevant administrative departments, schools and institutions show the great love concept of “life is precious”, and this humanized principle, idea and practice has also won widespread praise from students and parents. With the strong guarantee of “cloud examination”, “cloud preparation” and “cloud teaching”, the preparation of graduating students is more orderly, and the psychology of graduating students is more balanced and stable. Even the infected examinees will not lose valuable opportunities. For example, a third grade of senior high school student, a COVID-19 confirmed case in the Shelter Hospital of Wuhan (the hospital devoted to the treatment of COVID-19 confirmed case), as he received treatment, he learned all subjects online, with detailed and thoughtful preparation plan. From the specific aspect, because the test place of “Cloud National Examination” is generally located in the examinee's home, and the task of invigilation is generally undertaken by the parents. The familiar home environment and close family can relieve the examinee's tension to a large extent, which is more conducive to the on-the-spot play. In addition, the convenient and quick online form, will not only avoid the examinee and the parents running back and forth, it also can save a lot of money, such as transportation fare,

accommodation, etc., and it is the same for invigilating teachers and marking teachers, which reduces a lot of workload and work pressure. The embodiment of these aspects is also meticulous human care. What's more, under the special situation of national anti-epidemic, the extraordinary experience and test of “Cloud National Examination” will not only impress the examinee for life, but also make the students feel the full warmth and love of the country and society, and realize the power of national online education and technology. These students will grow into a generation of caring and responsible people in the future. Therefore, “Cloud National Examination” stands in the perspective of education and people's livelihood, relates to the epidemic situation, cares for examinees, and is “a special memory of individuals and families, an attempt to innovate in education, and a collaboration to overcome the difficulties together.” (Yi, 2020)

No matter how important an exam is, it can't lose life and health. What's more, it involves the overall deployment and strategic layout of national social epidemic prevention and control. At present, “Cloud National Examination” is not only a good way to solve the impending time and the unsettled situation of the epidemic, but also a good medicine to protect the life safety of the examinees. Therefore, no matter how many difficulties there are, “Cloud National Examination” is bound to be carried out. It's not just an important measure, but also a great care, showing the temperature of China.

#### 4.1.2. Tackling key problems in technology to realize complete online processes of National Examination

If the epidemic prevention and control is a large-scale war against COVID-19, then the “Cloud National Examination” is undoubtedly one of the “crucial battles”. The process of the national examination is complex and strict. It is difficult to put all the processes into the cloud. What is tested is the ability of the education administrative department and the school to deploy, coordinate, and implement in a short time. The strategic layout and cloud model test operation that have been carried out all over the country, from cloud-made examination paper, cloud registration, cloud qualification examination, cloud examination paper distribution, cloud examination, cloud invigilation in examination, cloud submission, to cloud review, cloud statistics, cloud check the mark, is not only an in-depth and thorough technological innovation, method innovation, thinking innovation, concept innovation, and even field innovation, it is also a strong proof of the national common fight against the epidemic.

#### 4.1.3. Laying the foundation stone of large-scale online national examination

As we all know, the rapid development of global education informatization and network emerging technology has a fundamental impact on the traditional education. As a new form of education, online education has no doubt about its development and evolution. It is true that online education is not simply to inject high-tech network technology into the educational body, but to implant Internet thinking on the basis of following the educational characteristics and rules, to break the traditional inherent organizational form of education, and to create a flexible, diverse and personalized education space to meet the multi-dimensional teaching needs in the Internet era. The “Internet + Education” strategy of China is actively rooted in the concept. It is also the concentrated embodiment of “Internet thinking with Chinese characteristics” (Jian, 2017). The leading application of China's 5G technology in globe and the implementation of “Block chain + Education” also provide guidance and support for the stride forward and firm progress of digital education. Therefore, from the perspective of the future development trend and direction of education, “Cloud National Examination” is bound to come true.

During the epidemic, China's online education has created a miracle of linear rise, stable and efficient operation. Only “Ape Tutoring”, an online education company, has more than 400 million users in China. (Qi, 2020) As the highest level of difficulty coefficient, once the “cloud country test” is officially implemented, it will birth a new era. At this



stage, “cloud mock examination” and “cloud examination preparation”, just like the injection of oxytocin, can shorten the whole process of the birth of “Cloud National Examination”. Just as the COVID-19 epidemic and the Chinese national anti-epidemic campaign will surely be recorded in the history of mankind, even if the “Cloud National Examination” only carried out in part, it will be recorded in the history of human education, science and technology. At the same time, it will become a magnificent scenery on the road to the full implementation of the “Cloud National Examination”, and an important milestone in the development of online education in China and even in the world.

#### 4.2. Problems and Thinking

China's COVID-19 epidemic has changed greatly from outbreak to effective control, and then to a slight rebound. At present, the epidemic situation is still not completely contained, and some schools, especially college and university students, are still unable to return to campus normally. In this regard, “Cloud National Examination” is bound to be implemented. However, although its path is scientific and reasonable, and it has great humanistic concern, it is difficult to operate in practice, and the formal implementation must be carefully deployed, coordinated, and scientifically assessed in the current period, which needs to resolve at least equipment, standard, and honesty and credibility problems.

##### 4.2.1. Equipment problem

During the period of SARS in 2003, although online examinations were carried out in relevant national examinations, such as in the second round examination for postgraduates, due to the limitations of network facilities and equipment, it was limited to some interview test, some even use the way of telephone connection. After nearly 20 years, today's Internet technology and the popularity and advancement of Internet facilities and equipment are totally different from before. “As of June 2019, China's Internet users reached 854 million, an increase of 25.98 million compared with the end of 2018, and the Internet popularity rate reached 61.2%.” (China Internet Network Information Center 2019) However, the “Cloud National Examination” is different from the ordinary test, and each detail is not allowed to be any problems, and the requirements and quality of the equipment are not allowed to be a little sloppy. On June 8, 2015, the failure of the English listening broadcast equipment in two examination classrooms (60 examinees) in Wuhu City, Anhui Province caused the students and their parents to gather on the campus, and more than 1000 examinees retested their English listening; on June 8, 2017, the same failure of English listening equipment of an examination place in Weinan City, Shaanxi Province affected nearly 500 examinees, which also aroused great public attention. Therefore, even in today's Internet popularization, to ensure the safe, orderly and stable implementation of the “Cloud National Examination” and to ensure fairness, justice and effective elimination of cheating, the equipment and technical requirements involved are quite high (Table 1). For national examinations such as the national college entrance examination in a large-scale and unified time period, on the one hand, the number of examinees is large, widely distributed, the family situation is uneven, and for the partial poor areas such as mountain area, not only the wireless network is not connected, but also the mobile terminals and other devices are not available. Even many urban families cannot be equipped completely. On the other hand, during the epidemic, the large-scale online teaching is unprecedented, which thoroughly tests the ability of online education platform equipment and operation management. “Internet giants took advantage of the platform during the epidemic, and involved in providing online education solutions, online collaborative office, teaching and teaching management and other related products, technologies, and content resources. All of them were open for free during the special period.” (Haiguang, 2020) Although still running well, it is also based on the peak shifting. Moreover, it has been complained a lot by people because of failure of

timely network equipment bandwidth, network delay, stagnation, and even collapse. (Jianli et al., 2020) In addition, the technical problems of confidentiality, examinee information and privacy protection also need to be considered and solved. Therefore, it is really difficult for the existing equipment and technical conditions to ensure that the “Cloud National Examination” is foolproof.

##### 4.2.2. Standard problem

The traditional national examination has experienced many years of operation, management, adjustment and improvement. In every process, and even every detail, it has been carefully demonstrated and operated several times. It is a practical examination scheme and examination system, and its standards are mature and standardized. The epidemic situation is pressing, time is pressing, and the “cloud mock examination” that has already been carried out is also being tested adaptively. Although the management department and the school are scientific demonstration, prudent decision-making and meticulous policy-making, the large-scale “Cloud National Examination” is an unprecedented new thing after all. Compared with some operations in the SARS period in 2003, it is not comparable. In addition to providing adequate equipment guarantees, the establishment of all aspects of operation and implementation standards is crucial.

Take the postgraduate second round examination as an example. Compared with the preliminary examination, although the percentage of the second round examination score is lower, its importance is not inferior to the preliminary examination. It is an examination of the comprehensive literacy and ability of examinees on-site answer processing ability, knowledge perspective, personal mentality and other aspects. What's more, the interview session in the reexamination can directly show the examinee's verbal expression ability, communication ability, ability to grasp opportunity, logical thinking ability, on-the-spot strain capacity and manners. For this reason, colleges and universities have always attached great importance to the assessment and evaluation of the second round examination. The traditional reexamination place for postgraduates is arranged by the education administrative department and the school that undertakes the examination task. It has a unified and clear standard. However, from the current “cloud interview” and relevant online tests, there is no very unified and clear standard for the examinee's home environment. The furnishing, background, and even light of the examination room will affect the examiner's judgment. It can only see the face, can't understand the behavior and manner of the examinee effectively, and can't guarantee the real-time of the online interview. There will be the phenomenon of voice and image delay, and the delay will affect the examiner's judgment on the examinee's response agility and on-the-spot strain capacity. Of course, the reason why there is no unified and clear environmental standard for home examination room is closely related to the complex and different home environment and family conditions of examinees. Although this is caused by examinees' own reasons, in most cases, it is not their subjective intention, but they are forced to be helpless. Therefore, it will influence the exertion of examination level and result in the unsatisfactory achievement, this has also led to a certain degree of injustice and unfairness.

From the perspective of teachers, taking “cloud college entrance examination” as an example, the main task of teachers in the cloud examination is “cloud examination”. Although the same as the traditional college entrance examination, “cloud college entrance examination” is bound to develop a set of scientific system and detailed and operable online scoring process and criteria, so that all levels of education administrative departments and schools can organize teachers to review at home. However, the traditional college entrance examination marking is usually done by teachers in a centralized way. The advantages of this are as follows: first, teachers can concentrate on marking in a closed space without any distractions, so as to complete the task of marking in a timely and efficient manner with quality and quantity guaranteed; second, in case of a few examinees' answers,

**Table 1**  
List of equipment and system resources required for “Cloud National Examination”

Equipment and system resources prepared by examinees		Equipment and system resources prepared by Education administration departments and schools	
Equipment	System software, network and other resources	Equipment	System software, network and other resources
Mobile terminals such as computers, tablets and mobile phones (hard disk: more than 5GB of free space, memory: more than 512MB; CPU: 1GHz Pentium level or more advanced processor), 360 degree panoramic camera, microphone, etc.	Microsoft, Android, iOS or Linux based operating system, online exam system, 4G network, etc.	Server cluster, identity authentication and recording equipment with voice, fingerprint, face or iris recognition functions, memory equipment, etc.	Web server (APACHE 2. X or above, IIS6 or above, nginx0.5 or above), database server (MySQL 5.0 Or above), Microsoft or Linux operating systems based on Linux kernel 2.6.30 or above, freeBSD6 or above, 4G network, online examination system, online marking system, statistical analysis software, security encryption system, intelligent monitoring system, equipment failure online warning platform, etc.

especially the subjective questions and compositions, which are difficult to mark and evaluate under an emergency situation, the teacher can report to the marking team leader real-time, and the marking team leader can launch discussion with the other teachers of the same group in time, to give the evaluation criteria and solve the problem quickly. The home online marking method cannot do this real-time. For special cases, the timeliness of standard judgment is low, and the degree of research and judgment is not as strong as the traditional centralized method.

#### 4.2.3. Honesty and credibility problem

Although cloud based examination has many advantages, it is a big problem how to ensure that the examination monitoring is in place, completely eliminate cheating and ensure fairness and justice. First of all, at present, the invigilators of “cloud mock examination” are all parents. The reason is that there are a large number of scattered single home test places. If schools want to use the method of online invigilation of teachers, they can't arrange enough teachers to participate in the invigilation at all. The existing technical means can't realize the reliable recognition and determination of cheating by machines. However, the national examination is crucial for every examinee and family. Therefore, it cannot be ruled out that parents participate in cheating as invigilators, especially parents who are familiar with the subject area of knowledge. For the possible cheating ways in the process of examinee's answering paper, such as invigilating parents hinting with limbs or winks, examinee's entrainment, electronic screen projection, a substitute test of twins or multiple births, etc., although it can be technically required to equip a panoramic camera without dead angle, it can also be solved by cooperating with the image analysis examination monitoring system, or it can be technically solved by voice, fingerprint, face or more high-level iris recognition, however, it is difficult to achieve in reality. It is not realistic to require every examinee's family to install 360 degree panoramic intelligent camera. Moreover, collecting these biological information and installing related equipment also involves a lot of human, material and financial resources. In addition, even if it can be done, for some special cases, such as the supervision of examinees' going to the washroom during home online test, it is difficult to solve the problem. Therefore, in addition to the continuous improvement of equipment technology and operation processes, it is also necessary to integrate the exam honesty and credibility behavior of “Cloud National Examination” into the personal integrity evaluation system and credit reporting system, so as to effectively solve this problem. For examinees, cheating will affect their future employment and social activities, and for parents, it will also be reported to their units, and corresponding punishment will be made. Even if they are self-employed or freelance, cheating record can also affect their loan financing and other behavioral activities. However, this also requires big data analysis and the cooperation of related systems and

management departments, which requires a coordinated and gradual process.

### 4.3. Discussion

#### 4.3.1. Discovery and Enlightenment

Through the above analysis and thinking, we can find that the “Cloud National Examination” and even “Cloud Examination” are the inevitable trend of China's education development, because it is based on the “Internet + Education” strategy, and has also benefited from the long-term good trend of China's economy, science and technology and society, it also lays the foundation and reliability of this study. The COVID-19 epidemic, which appeared in December 2019 and continues to this day, is undoubtedly a large dose of catalyst, which greatly accelerates the process of online education in China. The special status of national examination in Chinese society determines that during the epidemic period, the strength of all sectors of society should be concentrated to solve its many problems quickly and safely. Therefore, “Cloud National Examination” has become one of the important alternative solutions. This paper quickly grasps this social focus, and reveals the deep-seated social phenomena and problems related to this theme, and carries out a systematic theoretical review based on the analysis of the organic relationship between “Cloud Anti-COVID-19 Epidemic” and “Cloud National Examination”, such as the attitude and action of the Chinese government and society in fighting the epidemic situation, attaching great importance to the safety of the people's lives, etc. While presenting readers with a complete picture of the response mechanism of the national examination and its related social reaction during the outbreak of the epidemic in China, this paper makes deep thinking and enlightenment, and puts forward a series of key problems and details that need the government, schools, educational institutions, scientific and technological circles and academic circles to work together to solve in the next step, which can effectively improve the “Cloud National Examination” mechanism.

#### 4.3.2. Implementation and dispute

Faced with the countdown of the national examination, on the one hand, China's Ministry of Education made real-time assessment, comprehensive research and judgment, and prudently put forward the response plan. First, in February 2020, all enrollment units were required not to hold large-scale gathering activities and examinations during the epidemic period, and then issued an announcement in March 2020 that “the college entrance examination will be postponed for one month” (China's Ministry of Education 2020), that is, it was postponed from the June 7 to July 7. There are two reasons. One is that, the college entrance examination was held in July from 1977 to 2002, so the government and schools have rich experience in holding the college entrance examination in July. The other reason is that, the epidemic

situation had been effectively controlled at that time, and in Wuhan, China where the outbreak was first reported, the epidemic was most serious, the lockdown restriction was lifted on April 8. Educational institutions and schools at all levels have issued detailed epidemic prevention and control plans, and have made clear specific responsibilities, to effectively respond to emergencies. The government has also released a classification of epidemic risk levels covering 301 regions across the country. There are very detailed prevention and control measures corresponding to different levels in areas with different risk levels. In addition, every teacher and student need to check their body temperature and scan code on mobile phone to report health status every day. In order to ensure the life and health safety of the people as much as possible, in addition to the most important national examination, it has cancelled a number of large-scale examinations which were originally scheduled for the first half of the year, such as Public English Test System (PETS), National Applied Information Level Test (NIT), National Computer Rank Examination (NCRE), Chinese Calligraphy and Painting Tests (CCPT), College English Test-Spoken English Test (CET-SET) and so on. Subsequently, local education administrative departments have postponed the examination time of senior high school entrance examination to mid-July 2020.

On the other hand, the online examination scheme is emerging more and more. Beijing and the three provinces in Northeast China took the lead in carrying out the simulated test of “Cloud College Entrance Examination”, and many places followed suit. Large online education institutions also launched the “Cloud Senior High School Entrance Examination” and “Cloud College Entrance Examination” of “million people online simulation test”. Because the graduate examination is carried out independently by colleges and universities, not only the examination scheme and paper content are independently determined by each school, but also the strength of personnel, equipment and technology in Colleges and universities is relatively strong, and the comprehensive online technology application ability of candidates is also strong, and the number of candidates is relatively small. Therefore, the formal “Cloud Examination” has been carried out in the post-graduate second round examination and the written entrance examination and interview for doctoral candidates.

In summary, the Chinese government has taken active action and classified treatment for the national examination, that is, the unprecedented large-scale “Cloud Examination” has been adopted in the graduate entrance examination; the traditional offline examination has been postponed for the college entrance examination and senior high school entrance examination, but a series of special methods have been adopted for the epidemic situation, such as reducing the density of examination room, disinfecting and ventilating the examination room, scanning code to register health status, and increasing the number of epidemic prevention medical staff, wearing masks throughout the examination, body temperature measurement at entrance of examination and other anti-epidemic measures; and temporarily cancelled other national large-scale examinations. Therefore, the “Cloud National Examination” proposed in this paper has been partially realized and applied.

Taking the successful implementation of the “Cloud Examination” for graduate students as an example, the examination is carried out after the Ministry of Education gathers the strength of universities and research institutions, and conducts in-depth demonstration in all aspects (Figure 1). It is the first time in China's history that the whole process of the large-scale national examination is implemented online. It not only accumulates rich experience for the future comprehensive development of “Cloud State Examination” including “Cloud National Examination” and “Cloud Senior High School Entrance Examination”, but also provides an important precedent for similar global problems and phenomena.

In the process of implementation, first of all, the Ministry of Education requires colleges and universities to formulate “one school, one plan” online examination scheme based on their own actual

situation and the different examinees' situations, and submit it to the education administrative department for approval. Secondly, as summarized in the literature review, at present, the relevant links and processes of online examination, as well as the technical research and preparation work have been carried out, such as the application of research results, for instance, the use of face recognition technology to achieve the verification of candidates landing in the “cloud examination room”, component encryption and database encryption technology and SSL data transmission technology, etc. Thirdly, online registration and online qualification examination of candidates are carried out in China Graduate Enrollment Information Network. After confirming the candidates' qualification, the school will contact the candidates in advance to establish a QQ group (Popular social media in China), and release the remote examination system examinee operation manual, inform the candidates to install and register online examination system and related Apps in advance, and check the examination network and equipment one by one. One hour before the formal examination time, the candidates are required to log in and test network and equipment again to maximize the guarantee of smooth examination. The examination system is mainly the recruitment remote interview system of the Ministry of Education of China or Tencent online conference system, and the examination adopts the form of dual-position camera. One camera is used in front of the examinee to take part in the examination, accept the test instructions, receive the written test questions or carry out the interview assessment, usually a laptop or desktop computer, and the other camera is used to present the scene 45 degrees behind the examinee. It's usually a smart phone. Finally, during the formal examination, the invigilating teacher will monitor and guide real-time, record the whole process. After the examination, the examinee must take photos and upload the content of the answer paper within 10 minutes, and mail the answer paper within 1 day. Judging from the running status of the national scale “Cloud Examination” for graduate students, it is successful, but there are also many disputes, problems and the appeal of the public. Many of them correspond to the problems raised in this paper. For examples, there are many network delays, stagnation, stuck and so on, which are usually handled within 2 minutes and the corresponding examination time will be postponed. In an interview, if it takes more than 2 to 5 minutes to solve the problem, the examinee must re-extract the test questions after entering the online examination room again. If more than 5 minutes, the test will be invalid, and the examination will be rearranged according to the situation. The overall absence rate is higher than that of the traditional examination due to equipment problem and other factors, and some candidates have a strong complain to it. Because it's not allowed to go to the washroom midway, the online examination time is shorter than the traditional examination. Moreover, for the convenience of answering questions and submitting online, there are less types of questions, more subjective questions and more open questions. Therefore, it is hard to comprehensively test out the true level of candidates. Some schools, because the online written examination is not suitable for operation, directly cancel the written examination, and then increase the extraction of test questions for oral answers in the interview, thus, the examinee's time of thinking and answering is greatly shortened, which is very disadvantageous to the candidates who are good at the written examination. In addition, even the postponed college entrance examination and senior high school entrance examination did not go well. In July every year, southern China is in flood season. In 2020, extreme weather happened in southern China. As a result, catastrophic floods and debris flows occurred in large areas of the south, many candidates cannot go to the examination room, and some of examination rooms are even destroyed, which makes the implementation of the national examination worse under the epidemic situation. Therefore, many people in the South complain that the online examination scheme should have been adopted.





Fig 1. Cloud postgraduate examination on-site scene

#### 4.3.3. Future development and research

It is true that, driven by the “Cloud Anti-COVID-19 Epidemic” mode, although China’s “Cloud National Examination” mechanism has made a great stride forward, there are still many uncertain factors in its development. The problems that need to be solved in the aspects of equipment technology level, system standard level, and honesty and credibility level, which are put forward in this paper, are important objects for future development and research. In terms of equipment technology, it is not only necessary to solve and realize the continuous upgrading of software and hardware and the continuous maturity of 5G technology, but also social problems such as the equipment environment of examinees’ families, the overall improvement of middle school students’ network technology application ability, and so on. On the level of system operation standard, we need to balance the development of different educational resources in different regions as far as possible, and make overall consideration of different geographical environments, climate conditions, and ethnic and cultural factors, so as to achieve the near-same standard with minor differences, and classified implementation. In terms of honesty and credibility aspect, it is necessary to incorporate the test credit of “Cloud National Examination” into the national personal credit evaluation system. In addition, “to ensure honesty and credibility and prevent cheating, we need to consider technology, the design of examination questions and rules, and the whole evaluation strategy, and take multiple measures together.” (Manli, 2020)

At present, the current epidemic situation in China has some rebound. Even if COVID-19 epidemic stops in the later stage, it is difficult to guarantee the rampancy of other viruses in the future. So, “Cloud National Examination” as the best means to adapt to the development of science and technology and to deal with any large-scale epidemic situation, as analyzed in this paper, will have a wide application in the future. Thus, the analysis and evaluation of its future development and the research on related issues need to be continuously and vigorously promoted and deepened.

## 5. Conclusion

On the one hand is the severity and complexity of the epidemic situation, on the other hand is the worries, anxieties and even frustration of the examinees who stand at the important crossroads of life; on the one hand is the debut and first application of national large-scale online examination, on the other hand is the attention and focus of the public, and the “Cloud National Examination” carries a lot of pressure, challenge, expectation and hope. However, although the specific

policies and measures of “Cloud National Examination” have not yet been finalized, and there are still some problems and deficiencies, under the situation of “Cloud National Examination”, its battlefield horn has been sounded, all forces have been actively preparing for the war, the sword has been sheathed, and there is no fear of the situation. The flag of “Cloud National Examination” is accompanied by lots of special and warm scenes, inspirational stories and experiences, and will become a generation of unforgettable memory.

## Acknowledgment

This work is supported in part by the key online teaching reform research project of Anhui Polytechnic University “Research on online implementation and management of international students’ intelligent classroom and practical teaching in case of outburst of large-scale epidemic” (2020xsjyxm08); 2018 Anhui provincial quality engineering project “Sino-foreign cooperation training project” (2018zwp001) and Zhongjiang scholar talent project of Anhui Polytechnic University.

Zhu Tiejun,  
Anhui Polytechnic University, Wuhu, China  
E-mail address: [ztj@ahpu.edu.cn](mailto:ztj@ahpu.edu.cn).

## References

- China National Health and Health Commission. Update on Novel Coronavirus Pneumonia epidemic situation at 24:00 on April 15th, 2020, Learning Power, 2020-04-16.
- China’s Ministry of Education, 2019. 2019 National Education Development Statistical Bulletin. July 24.
- Yufei, Yuan, 2020-02-12. When schools start, how to solve the employment problem, and whether the college entrance examination will be postponed – Ministry of education explains in detail the epidemic prevention and control issues of public concern. Guangming Daily Newspaper.
- Yi, Li, 2020-03-04. Beijing’s “Home-based college entrance examination” tests out a national war against epidemic. Beijing Daily Newspaper.
- Jian, Huang, 2017. Led by Internet thinking, China’s “Internet + Education” strategy. China Educational Technology 1, 99–104.
- Feng Qi, Breaking the classroom wall, Ape Tutoring online education has more than 400 million users, Beijing News, <http://www.bjnews.com.cn/edu/2020/01/20/676755.html>, 2020-01-20.
- China Internet Network Information Center, the 44th statistical report on Internet development in China, 2019-08-30.
- Xin Haiguang, Active participation of four forces, continuous development of online education, 21st Century Economic Report, 2020-02-10:008.
- Jianli, Jiao, Xiaoqing, Zhou, Zexuan, Chen, 2020. Case study on online teaching of “non-stop teaching and non-stop learning” under the background of epidemic prevention and control. China Educational Technology 3, 106–113.
- China’s Ministry of Education, 2020-03-31. Announcement on the schedule of national college entrance examination in 2020. Central People’s Government of the People’s Republic of China. [http://www.gov.cn/xinwen/2020-03/31/content\\_5497426.htm](http://www.gov.cn/xinwen/2020-03/31/content_5497426.htm).

Manli, Li, 2020-04-03. The implementation of online teaching during the epidemic, how to test? New Tsinghua University Newspaper.

**Zhu Tiejun** is currently an associate professor, postgraduate student supervisor and Zhongjiang scholar of Anhui Polytechnic University, Wuhu, China. In recent years, he has

been approved 25 provincial and municipal levels scientific and teaching research projects. He has published 60 academic papers, obtained 14 China national patents, and published 3 academic monographs in China national first level press. He has won more than 10 provincial teaching, research and competition awards as well.